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ABSTRACT

This report, the first of a series on productivity and job security, presents five case studies to illustrate retraining to achieve worker's adjustment to technology. The first of seven chapters addresses the following issues: the availability of job training/retraining data, the desirability of informing workers in advance of technological change, advantages/disadvantages of training methods, and the general effectiveness of retraining to assure job security. The first case study, presented in chapter 2, discusses the removal of foundry worker's apprehensions about moving into a new foundry through on-the-job training (OJT) and assurances that job declines would be met through attrition. Chapter 3 examines a case in which single craft mechanics were transformed to multicraft personnel through OJT and home study. The fourth chapter contains a case in which graphic arts innovations and employer attitudes resulted in mature worker's layoffs. Chapter 5 discusses the use of simulation to upgrade welders' skills. Chapter 6 recounts a case in which Detroit retrained building inspectors. The importance of continuing education and training are emphasized in chapter 7. This final chapter formulates policy implications and suggests that efforts to achieve high productivity through technology is generally accepted by unions provided companies pursue a job security policy. (Other reports in this series are also available--see note.) (CSS)

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PRODUCTIVITY AND JOB SECURITY: RETRAINING TO ADAPT TO TECHNOLOGICAL CHANGE

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PREFACE

Economists who have studied the sources of our productivity growth give great weight not only to technological changes which lead to productivity improvements but also to the ability of the work force to adapt to those changes. Public Law 94-136, which established the National Center for Productivity and Quality of Working Life, recognized this need. Retraining either on the job or in institutions offers a major means of accommodating to new technology and, at the same time, maximizing the employment security of workers affected by change. Accordingly, one function of the Center under PL 94-136 is to "identify, study, and review retraining programs. . . designed to counteract threats to job security which may result from efforts to improve productivity."

This report is the first in a series titled Productivity and Job Security which is planned in response to the Center's charter. The five case studies which comprise the report are presented here under the subtitle, Retraining to Adapt to Technological Change. They deal with various kinds of technological change, including the restructuring of work, and illustrate how different forms of retraining can assure an orderly adjustment to technology by workers. Field visits were made to private firms and separate training establishments in the first four cases. It was not feasible to make personal field visits in the case of Detroit's inspection program. Instead, lengthy telephone conversations were held with the director of the Detroit Building

Department, the assistant building safety director in Phoenix, and the training coordinator for the Los Angeles Department of Building and Safety. Also made available were speeches by the general manager of the Los Angeles Department. Where footnotes are cited, they appear at the end of their chapters.

The Center acknowledges with deep appreciation the frank and thoughtful descriptions of retraining experiences which corporate and union representatives shared. Thanks are also extended to the local government officials who provided data for one of the case studies.

This report was prepared by A. Harvey Belitsky, a consultant to the Center. Edgar Weinberg, Assistant Executive Director and head of the Center's human resources program, provided direction in its preparation.

SUMMARY AND POLICY IMPLICATIONS

Summary

This report presents five case studies of worker retraining with the objective of determining the usefulness of retraining in protecting the job security of workers affected by technological change. Four of the case studies deal with privately sponsored retraining; the fifth concerns retraining in local government. The limited extent to which job-related training is pursued on a continuous basis, rather than as ad hoc and often hasty responses to innovations, is also considered.

Chapter 1 finds that the available national data on job-related training and retraining give an inadequate picture of the extent of retraining. Also dealt with are several general issues affecting the use of retraining for job security: the desirability of informing workers in advance of technological change; advantages and disadvantages of different kinds of training; and the general effectiveness of retraining in assuring job security.

The findings concerning the usefulness of retraining as a job security measure can be briefly summarized under the chapter titles for each case study.

Retraining for New Technology in a Foundry--Apprehension of the work force concerning the move into a new foundry was removed and adjustment to the changeover facilitated through on-the-job training (OJT) and assurance early in the process that job declines would be met through attrition.

Training Multicraft Mechanics in a Paper Mill--Transforming single-craft mechanics into all-around maintenance personnel involved up to three years of OJT and home study with "programmed learning."

Institutional Retraining of Graphic Arts Workers--Substantial innovations within the graphic arts have resulted in the layoff of mature workers in, for example, photoengraving. While these workers have enrolled promptly for retraining, they and their newly acquired skills have not always been in demand, in part due to employer preference for competent younger journeymen.

Institutional Upgrading of Welders--The AIRCO division which manufactures welding equipment and supplies determined that semiautomatic welding processes would continue to expand in several high technology, growth industries if enough welders could be trained in the new processes. AIRCO has several schools and these attempt to simulate on-the-job conditions in their instruction.

Retraining Building Inspectors in Local Government--The City of Detroit retrained single-skill inspectors into general building inspectors through short and intensive training. The opportunity to remain employed provided strong motivation to complete the training.

The Case for Continuing Education/Training--While the case study approach can be instructive for learning about typical retraining accommodations to new technology,

continuing education and training may yet prove to be the ideal means of adjusting even when a technology requires some short, specialized training or even a shift to other jobs.

Policy Implications

1. The case studies suggest that the effort of private firms to achieve higher productivity from new technology is generally accepted by unions as a means for assuring a company's competitive viability, provided the firms pursue a policy of job security, including all or most of the following:

- o Adequate advance notice of impending technological change
- o Assurance that any required layoffs will be minimal and achieved by natural attrition of the existing work force
- o Assurance that the current work force will receive any retraining needed to adapt to new technology

2. Such assurances are usually feasible because management knows beforehand most of the employment and skill changes associated with changes in technology. Therefore, successful efforts to improve productivity must plan for changes in manpower, including projections of needed skills and training.

3. Job redesigns which raise productivity by modifying and enlarging job skills and tasks may be perceived as threats to employment; thus these require the same job security 3

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provisions as those technologies which involve major changes in equipment.

4. Continuing education and training may be a useful way of avoiding the disadvantages of high specialization. Specialization reinforces inflexibility in workers whenever major adjustments to new technology are required. It is also likely to deter workers from suggesting those "minor innovations" which, taken together, are responsible for a large share of the advances in productivity.

5. While the shift from single to multicraft duties for maintenance mechanics can raise productivity in a service function, fairly extensive retraining is involved.

6. Only a modest number of workers take advantage of company paid tuition for courses which improve job performance. Such courses would enjoy greater enrollment if employers and unions were to develop jobs which utilize the know-how taught.

7. Middle-aged and older workers in firms which introduce labor-saving technological changes would especially benefit from greater opportunities to take job-related courses, since workers with skills broadened through continuing education and training are more likely to be able to move to jobs within the innovating firm or in another firm.

8. Training under actual working conditions is the major advantage of OJT, but OJT can
4 suffer if management views it as competitive

for the human and material resources which are also committed to production. For its part, institutional instruction, which simulates actual job conditions, can design training to take into consideration problems that do not arise regularly in the course of work. A combination of OJT and instruction within a training institution maximizes the advantages of each.

CHAPTER 1. ISSUES IN RETRAINING

This chapter deals with issues of retraining to (1) adapt the work force to technological change and (2) assure the job security of workers. They provide a setting for five case studies presented in this report. A sixth "case," for continuing education/training, may itself be considered an issue, propounding as it does the view that continuing education and training is preferable to the intermittent retraining which usually follows the introduction of a new technology. Issues considered are:

- o Importance of Retraining
- o Informing Workers of Retraining
- o Major Kinds of Retraining
- o Extent of Retraining
- o Effectiveness of Retraining in Assuring Job Security

Importance of Retraining--From the workers' viewpoint, retraining is any training that takes place after the first major training is completed. When job requirements change, the successful completion of retraining may be the prime requirement for remaining employed. From the employer's viewpoint, retraining is the means by which productivity increases can be realized from technology--new equipment, machinery, or processes; new methods or organization of work. Therefore, both workers and management have an interest in the timely provision of retraining.

Modifications in work methods often break down or regroup old craft lines. The clustering of functions from one or more crafts into altered, or even new, occupations is evident in three of the four private sector case studies and the one from local government. Retraining for this is potentially applicable throughout the country to many skilled maintenance workers in a number of industries.

Informing Workers of Retraining--Even though continuity in employment is the result of retraining, workers tend to feel threatened initially by new technology, which usually changes customary production methods and thus changes the way jobs are performed.

This uncertainty can be allayed by providing workers as early as possible with as much knowledge as possible about the new technology's impact upon employment, skill, and retraining requirements.

Of course nonunion as well as union firms adopt major technological changes requiring retraining. However, the case studies in this report deal predominantly with unionized firms because: 1) a substantial part of all major technological change occurs in the unionized firms of major industries; 2) collective bargaining agreements make most likely the "codification" of policies concerning advance notice of technological change and retraining; and 3) some unions are particularly active in training and retraining and operate their own training institutions.

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The Bureau of Labor Statistics (BLS) has found various job security provisions in collective bargaining agreements which cover 1,000 or more employees. As of July 1, 1974, a survey of 1,550 agreements revealed that less than 10 percent dealt with advance notice of technological change. About 1.2 million workers, or 17 percent of those covered by these agreements, were protected by an advance notice clause.

Major Kinds of Retraining--On-the-job training (OJT) and training provided within an institution away from the job are the two major kinds of training.

OJT can be formal or informal. Thus, informal training can include the casual demonstration of an innovation by one worker or supervisor to another. Informal training can even be adequate for transmitting the know-how of major technological changes.

Nonetheless the trend toward formalized training seems to be increasing. According to two surveys conducted at different times by the Bureau of National Affairs, Inc., the greater complexity in business enterprises and production processes has made it necessary to explain not only how but why work is performed. 1/ A related belief is that a "modern technological society" may demand training and education throughout most people's working lives. 2/

While OJT has both advantages and limitations, some researchers call it the ideal training method for developing skills required

by technological change. Changes, such as in the frequent alterations in computer technology, can be transmitted to affected workers as they take place. 3/

OJT emphasizes learning by doing and keeps theoretical explanations to a minimum. This is particularly attractive to people who have been "turned off" by earlier experiences with book learning, 4/ or who for other reasons learn best from concrete occurrences. Moreover, OJT is relatively more permanent than formal classroom training, which, as a budgeted item, is subject to "cost reduction... once /a/ training crisis is past." 5/

However, a U.S. Department of Labor study determined that OJT does not "educate" workers to accommodate to change and that inplant training usually does not teach any skills which enhance worker mobility. 6/ This is quite predictable in view of the distinct likelihood that a firm will retrieve training costs when the training is specific; in contrast, "the investment costs of more generalized training which increases worker mobility may be lost if this allows the worker to change employers." 7/

Moreover, while it is possible to develop ideal circumstances for OJT, it is not easy because firms invariably rank training below production. 8/ "Because on-the-job training requires the same supervisory inputs, materials, and equipment as production, large-scale training can lead to serious drains on productive capacity." 9/ Another possible drawback to OJT can occur when workers

dislike showing other workers how to perform their job. Also OJT may not be able to train in all necessary situations; for example, a breakdown in a continuous flow operation which would have to be dealt with may simply not occur during a training period. 10/

Some firms subcontract a substantial portion of their training to special institutions because OJT interrupts regular working routines. The training programs of even a greater number emphasize OJT but provide related instruction in a private or public training institution. The expansion of formal training revealed by the Bureau of National Affairs, Inc. surveys referred to earlier may further indicate a greater preference for training away from a firm's premises. However, the job-related training provided by vocational schools or a community college should not be supposed to be totally different from OJT since training institutions at times simulate the actual work environment to the maximum extent possible.

The Extent of Retraining--No firm estimate is possible of the extent of training and retraining which private industry sponsors because most private (and public) employers do not tally training expenditures in consistent and measurable ways. 11/ That training is normally carried out informally only underscores the problem of arriving at any quantitative measure of training. Therefore, a recent attempt to determine the extent of various kinds of "work training" does not even attempt a firm estimate of the number of people being trained in formal OJT 11

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programs. 12/ Moreover, according to at least one manpower analyst, no two retraining situations are alike. "Circumstances vary with the nature of the production process, the types of occupations, and, perhaps most important, the rapidity with which changes are introduced." 13/ The episodic nature of retraining--especially when it is associated with technological change--reinforces the reason for using the case study approach.

It is, however, possible to estimate the number of OJT provisions in collective bargaining agreements with major employers (1,000 or more workers); on July 1, 1974, 3.4 million workers, or nearly 50 percent of those working under agreements with major employers, had OJT coverage. 14/

The extent of OJT within even the largely unionized industries cannot be judged only by tallying the number of agreements with OJT clauses because many "successful" union locals do not even attempt to include training clauses in their contracts. They rely, instead, on unwritten training agreements, even though the national unions suggest that the locals try to incorporate model clauses prepared by the national's research and education offices on many bargainable issues--including advance notice for technological change, OJT, and other forms of training and education. Such would be the case for many of the locals of the International Association of Machinists. Even in those machinists locals which have training clauses, the language ranges from highly detailed to rather vague. Yet it is obvious that machinists

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must undergo some forms of retraining, working as they do in such innovative industries as aerospace, shipbuilding, and electronics and needing such technologically advanced skills as are required by numerically controlled machinery and laser and electronic welding.

Effectiveness of Retraining in Assuring Job Security--The principal measure of job security following retraining is the availability or nonavailability of changed or new jobs for retrainees. One of the few empirical studies which tested this for workers in all regions and occupations found in 1967 that not many became jobless or incurred shorter working hours due to technological change. Ten percent of the workers did report that their jobs were changed; but most expressed satisfaction with the opportunities for increasing their earnings by working on more productive machines. Perhaps it can be inferred that accommodation was made to any necessary retraining. In addition, the study seemed to demonstrate that "better-educated workers" influenced the rate at which technological change was introduced. 15/

The adaptability of the work force can be further inferred from the variety of situations in which technological change took place, as reported in the five case studies. The cases deal with job-security provisions as they relate to modifications of plant, equipment, processes, and design of work. A great deal of variety was found in the cases: in advance notice to workers of technological change; in the kinds of on-the-job and institutional

arrangements for retraining; and in the status of people being retrained (current, new, and laid-off employees).

Continuing education itself is varied. Several forms of it are cited because of the growing importance of training as a form of "employment insurance" upon which workers can draw when their jobs are altered or even displaced by innovation.

Chapter 1. Footnotes

1. See Training Employees, Washington: BNA, 1969; cited by Harold F. Clark and Joe C. Davis, "Training in Business and Industry" in Developing the Nation's Work Force, Ed. by Merle E. Strong, Yearbook 5, Washington: American Vocational Association, 1975, p. 178.

2. Harold F. Clark, "Industry's Educational Commitment," The Encyclopedia of Education, Vol. 5, N.Y.: The Macmillan Co., 1971, p. 66.

3. According to at least one study such frequent changes are not quickly transmitted to educational institutions. See U. S. Department of Labor, Bureau of Labor Statistics, Computer Manpower Outlook, Bulletin 1826, Washington: USGPO, 1974, p. 11. This need not always be the case, however; outstanding private vocational schools keep abreast of changes in production through close contacts with employers. See A. Harvey Belitsky, Private Vocational Schools and Their Students, Cambridge: Schenkman Publishing Co., 1969, pp. 40-43.

4. Deficiencies in formal education can be overcome and "complex ideas" can be transmitted. Michael J. Piore, "On-the-Job Training and Adjustment to Technological Change," The Journal of Human Resources, Vol. III, No. 4, Fall 1968, p. 444.

5. Peter B. Doeringer and Michael J. Piore, Internal Labor Markets and Manpower Analysis, Lexington, Mass.: Heath Lexington Books, 1971, p. 112.

6. Manpower Administration, "Internal Labor Markets, Technological Change, and Labor Force Adjustment," Part II in Work Force Adjustments in Private Industry--Their Implications for Manpower Policy, Manpower Automation Research Monograph No. 7, Oct. 1968; cited by Larry M. Blair, Mechanisms for Aiding Worker Adjustment to Technological Change, Final Report on NSF Contract #DA39438, Human Resources Institute, Univ. of Utah, Vol. 1, Part II, p. 13.

7. L. M. Blair, Ibid.

8. Thomas H. Patten, Jr., Manpower Planning and the Development of Human Resources, N.Y.: John Wiley & Sons, Inc., 1971, pp. 137-138. However, vestibule "school" training may at times complement OJT; and, unlike OJT, training and not production is considered primary. Ibid, p. 138.

9. P. B. Doeringer and M. J. Piore, op. cit., p. 112.

10. Dorothy Wedderburn, Enterprise Planning for Change, Organisation for Economic Co-Operation and Development, Paris, 1968, pp. 77-78.

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11. However, see Chapter 9, "Human Asset Accounting," by Rensis Likert in The Human Organization: Its Management and Value, N. Y.: McGraw-Hill Book Co., 1967; also see Charles A. Myers, "Management and the Employee," Social Responsibility and the Business Predicament, ed. by James W. Mckie, Wash.: The Brookings Institution, 1974, pp. 348-349.

12. Willard Wirtz and Harold Goldstein, "Measurement and Analysis of Work Training," Monthly Labor Review, Vol. 98, No 9, Sept. 1975, pp. 19, 21.

13. Felician F. Foltman, "Xerox Corporation--A Case Study in Retraining," Management of Personnel Quarterly, Vol. 1, No. 5, Autumn-Winter 1962, p. 8.

14. U. S. Department of Labor, Bureau of Labor Statistics, Characteristics of Major Collective Bargaining Agreements, July 1, 1974, Bulletin 1888, Washington: USGPO, 1975, p. 71.

15. Eva Mueller, et. al., Technological Advance in an Expanding Economy: Its Impact on a Cross-Section of the Labor Force, Ann Arbor: Univ. of Michigan, Institute of Social Research, 1969; cited by L. M. Blair, op. cit., Part II, pp. 30-31. Blair does raise the possibility of statistical bias in the Mueller study because dropouts from the labor force were excluded and the sample of 2,662 was considered rather small.

CHAPTER 2. RETRAINING FOR NEW TECHNOLOGY IN A FOUNDRY

The firm represented in this case prefers anonymity, and is identified as GIF, an acronym standing for gray-iron facility.

GIF started as a blacksmith shop well over 50 years ago and is notable for the extremely modern foundry it built within the past five years. The firm is justifiably proud of the foundry which is called a metal-casting facility in order, according to the manager, to erase the undesirable connotations implicit in the word foundry. An international officer of the union representing GIF workers agreed that the facility is probably the most modern small foundry in this country.

GIF is one of two manufacturing divisions in the concern. The other, a machine tool division located nearby, makes GIF's castings into heavy industrial machinery (primarily high-speed presses for machine tool shops and stamping plants). That GIF has its own metal-casting facility distinguishes it from most machine tool manufacturers. The current work force of the metal-casting facility numbers 125 hourly employees. (The majority of foundries whose workers are represented by the GIF union have less than 250 workers.) Unlike other firms which have tried unsuccessfully to maintain both operations, GIF has consistently contributed to the firm's profits. Since the major technological changes and resultant retraining occurred only at GIF, this case is concerned only with that division of the firm. 19

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Three reasons were cited for building GIF. First, a cleaner environment would result from new processes which permit the reclamation of sand and control of emissions.

Second, castings would be of higher quality--they would be more accurate and look better; and according to GIF's executive vice president, higher quality can translate into higher productivity. Third, improved working conditions which would result would insure the ability to attract younger workers. (The chairman asked board members how the company was to continue to get workers even if the foundry was better than the average for the industry. One member who was resistant to building the new facility had only to stand in the old foundry for a few minutes: his white shirt darkened and his vote shifted.)

Changes in Technology--The stages in the metal-casting process were not basically changed by the new technology; however, the process itself was. The old foundry had utilized the black sand process; this involved adding binders and water to sand, making a mold, and drying it. Now, while the same sand is used, it is mixed and bonded with a chemical resin which "air sets" (that is, unlike the old process it needs no heat) and hardens much more rapidly, leaving no moisture in the molds.

Moreover the new process does not require ramming. Because the resin binder uses 75 percent less binders than the old process, it is more "flowable" and can be settled into place simply by vibrating.

The set time of molds under the new process is 30 to 45 minutes as opposed to 24 hours in the old. Cores are now set by infrared heaters in about seven minutes; before 10 to 12 hours were needed. Two coremakers are able to do the job, where six used to be required.

Another outstanding change involved replacing a large gas-consuming oven and a coke-consuming cupola with an all-electric, induction melting process. While the all-electric process is more costly per B.T.U., it is less polluting and affords better quality control.

The vertical channel induction furnaces are the most advanced in use; each furnace has a collar or pollution control, and a great number of outlets draw out dust or both dust and smoke. Compared to most foundries, the operation must be considered "clean."

The furnace area has a "pulpit," or electrical control booth, which allows operators at some distance away from the molten metal to achieve via pushbottons, knobs, and meters what was formerly done by hand shoveling. From the pulpit, it is possible to control a charging crane; open the top of the furnace; and select with a magnet either pig iron or scrap, which is then dropped into a bucket for which a scale provides a digital reading. Finally, a one-ton load is positioned over and dropped into the furnace.

Production and Productivity--Annual production in terms of good casting rose by 25 21

percent--from 6,000 to 7,500 tons. On a daily basis, the production of large molds (about 3,000 pounds casting weight) rose from 6 to 11. As a rough measure of the increase in labor productivity, the manager of GIF estimated that about 20 percent fewer man-hours was currently required for each ton of good casting. More dramatic changes in productivity took place within portions of the process. For example, a new sand mixer in the core room area handles 600 pounds per minute against 300 for the old mixer. In addition to hardening more rapidly, the chemically treated sand requires no manual patching and hence produces a higher quality mold. There is also less waste of various materials; for example, a reclamation system permits the reuse of sand and shot, the small hardened steel pellets used to break down and clean each casting.

Advance Notice of New Technology--The planning period for the new facility was two years and the construction period one year. Two weeks after the project was approved, the director of industrial relations, who is also in charge of training, met with union representatives to inform them of the plan, let them know that considerable changes would be required, and assure them that they would be kept "informed and involved." At first the union representatives were "apprehensive," as were several employees. The company thereupon decided to meet with all employees in small groups to inform them in detail of the changes, including floor plans of the new facility and the alternative jobs
22 anticipated to become available. The new

facility would be phased in, they were told, and would be operated on a parallel basis for some time. (The old foundry, which is still standing, is less than a 10-minute walk from the new facility.) The union was described as having been cooperative and it offered suggestions for implementing the complex changeover. The workers were also generally cooperative, possibly because they simply got "more attention than they normally received," and before long, "with good communications, suspicions were minimized."

For six months, a key foreman trained at the plant which was manufacturing the equipment for the new facility, and for another three months, he trained with a firm which already had an electric furnace. He then assisted in the installation of various mechanical and electrical units, and became involved as well in worker training.

Changes in Employment and Earnings--As a result of the new manufacturing processes, employment declined from 125 to 105 workers. There were no layoffs, with the changeover achieved by normal attrition, most of which occurred in the material-handling jobs that accounted for a major part of the productivity advances. Ultimately, total employment was restored to its original level as a result of higher output.

Employment increased immediately in some specific job categories: the maintenance staff rose from two to five persons with the addition of a night or "down" shift to maintain the more elaborate equipment; a few

additional welder slots also became available and some workers expressed interest in entering that occupation.

Earnings were not basically changed. Some "junior" journeymen were aware that their earnings would not be at the full rate until more journeymen were needed; as output expanded within the year, they were absorbed into the higher-paying classification.

Changes in Working Conditions--On balance, the volume of physically arduous work seemed to decrease, certainly for the machine operators. This includes the crane operators working in the air-conditioned crane cabs, who used to suffer from nosebleeds caused by high heat. Also, much physically demanding work, such as shoveling and piling sand, is simply no longer required.

Both union and management representatives agreed that the work conditions were better; however, they were not in complete agreement over the effects of all the changes. The manager felt that worker attitudes had improved as a result of the generally cleaner working environment. A powerized conveyor makes it possible to utilize people more fully and eliminates much standing around and "waiting," a change some workers said they appreciated because it removed the boredom from their work. Other improvements include air-conditioned wash and shower rooms.

The manager's feeling that some workers "oppose change for its own sake" seems to
24 have been indirectly corroborated by one

union official when he said that certain workers may not appreciate the improvements. However, dirt and heat must still be contended with in molding, and the conveyor may make work harder because workers no longer control the work pace. But according to the local union leader, grievances filed as a result of the new process did not increase markedly and certain grievances arose because it is just more difficult to please younger workers.

Changes in Skills--Fewer job classifications were an important outcome, in large part attributable to the elimination of several lesser-skilled manual classifications. The decline took place despite the designation for the first time of a "laboratory technician" for the melting process. Some jobs changed even though job titles remained the same; for example, an electric furnace operator still falls in the category of furnace tender, but the skills required are completely different.

Clear-cut conclusions are not easily drawn about the net skill effects for the major craft of molder. Some specialization had already been carved out, with the job classification having five levels. Under the new process, a single molder classification was effected through job enlargement, which, according to the casting facility manager, raised job satisfaction levels. However, in another sense, the molder position could be characterized by a decline in skill level, with the change for an old-time molder especially dramatic. In the old foundry (and many like it are still in operation) a molder could

occasionally make an entire mold himself, although, according to a union official, most do not have the range of talents of that "disappearing breed."

The manager observed that high-skilled molders, but fewer of them, are still needed. Except for patching, most skills are still utilized. However, every worker does not have to be a complete craftsman on the quasi-assemblyline or the flaskless molding line; a well-rounded molder is still necessary for the production of large molds.

At the manager's insistence, the apprenticeship program aims to produce molders who can look at a blueprint and "conceive how all pieces fit together." That such workers can also be shifted among functions is advantageous to the molders and to the company, which can, for example, maximize operating time on expensive new equipment.

The change in skill requirements for maintenance personnel was less ambiguous. Previously the maintenance duties were mainly those of a millwright; about three-quarters of the job entailed mechanical tasks and only one-quarter involved electrical problems. In the new facility all maintenance workers must be qualified in more than one of the skills needed to keep equipment in operating order, with the exception of one maintenance specialist who is expert in electricity and electronics. (Skill enrichment is even more pronounced for maintenance personnel at Westvaco; see Chapter 3.)

26

The GIF manager observed a rise in the technical or skill requirements for managerial, supervisory, and engineering personnel. This is associated with the greater need to become involved in preventive maintenance, since "more things can go wrong" with the new process, and all aspects are likely to be affected during a mechanical or electrical breakdown. Also repairs cost more.

The new technology can have the effect of reducing job mobility. Men who started their job careers at GIF as shipping clerks can still be found in responsible supervisory positions; however, they ultimately became persons with "background and experience" equivalent to many graduate engineers. In fact, Labor Department and Census Bureau surveys record thousands of "engineers" without college degrees. The higher formal education of job seekers is likely to reduce their number, unless the trend is inhibited by the Supreme Court decision (Griggs v. Duke Power Company) which compels employers to promote workers on the basis of job performance rather than educational attainment.

Training and Retraining--Most of the GIF journeymen required only modest retraining. As the manager of the gray-iron facility observed, no retraining problem arises "if you start with all-around craftsmen." While age did not in itself represent an obstacle, some older workers who were eligible to bid for certain jobs did not want to learn the slight differences involved; others were happy simply to continue doing the same work. 27

(They knew what new positions would offer because they had had the opportunity to observe all jobs, working, as they did, in a single facility containing all facets of mold and casting production.)

Some workers eagerly anticipated the technological changes and looked forward to the retraining for their changed jobs. "Apprehensive" workers were made to understand that full production was not expected immediately; the process of familiarization would be gradual. Further, the retraining was started in the familiar surroundings of the old foundry, where molds were made on a limited basis with the new chemically treated sand.

Except for maintenance and supervisory jobs, all training was on-the-job and most of it was carried out during working hours, as determined by a combination of factors--including the distinctiveness of the technology and the nature of the applicable labor market. For one thing, GIF became involved in welding a larger volume of heavy plates, but the local vocational schools (although considered "good") concentrate on light plates. (This deficiency in most public vocational schools is a reason why AIRCO launched its own welding schools. See Chapter 5.) For another, such advanced molding techniques are utilized by "only a handful" of firms in a four or five State area, and virtually their entire work force is clustered in the small community where GIF is located and nearby rural areas.

28

Although retraining was characterized more as "familiarization" than "extensive retraining," the firm could not indicate the duration of the "retraining," because it was still underway. This is probably not atypical when a new technology is introduced; however, journeymen did not receive continuous retraining since 1973, when the new facility began operations. Supervisory and maintenance personnel, whose jobs changed extensively, had home-study assignments for which they were paid. The union agreed that informal classes or OJT would not be enough and a maintenance worker specialized in electricity and electronics would have to be hired from the outside. The regular maintenance staff, from foreman to apprentices, was asked to take a few in-house courses, principally in blueprint reading. The blueprint reading course was given one hour before the start of the workday. It consisted of four hours per week over 16 weeks, and workers were compensated for the time.

Apprentice training continues to emphasize well-rounded craftsmanship because, with the considerable mobility in the plant, workers "can bid off a job just as they've become productive at it." Thus, molding, maintenance, and pattern chasing still have a four-year apprenticeship consisting of OJT, "experience," and some course work. The apprenticeship in maintenance has been expanded; each aspirant to a journeyman position must prove himself in electricity/electronics, pneumatics, hydraulics, and troubleshooting.

In terms of general development of the labor force, the company has a policy of providing tuition reimbursement for completion of job-related courses at a university or through correspondence.

CHAPTER 3. TRAINING MULTICRAFT MECHANICS IN A PAPERMILL

Westvaco, a major manufacturer of paper and packaging, began in July 1970 to operate the Wickliffe mill, a new $100 million, fully integrated pulp and paper facility in Western Kentucky near the confluence of the Mississippi and Ohio Rivers. An investment decision of this magnitude by a corporation whose annual sales at the time were almost $500 million obviously involved consideration of all recent paper technologies, and, in fact, the operation of many mills had been examined. Over the past 10 years, Westvaco had doubled in size while reducing its work force by 15 percent; this rise in production was credited to the more than $.5 billion in capital investment for the period.

Change in Technology and Advance Notice of the Change--The Wickliffe mill continued to emphasize the most productive technology, and while it put no new concepts into practice, it tried to get the most benefits from centralization of the entire process, including the power and recovery unit. Control of most processes in all departments was placed under instrumentation and computerization which requires monitoring by workers. (As with other firms in the industry, the digestor was computerized; the digestor is similar to a big pressure cooker which separates the lignin and cellulose fiber in wood chips.) And possibly the world's fastest fine papers machine was installed. While the Wickliffe mill used the most inventive 31

machinery and equipment, major productivity improvements resulted from utilizing manpower on existent technology more fully than had been done either at Westvaco mills or other paper manufacturers.

According to the manager of the Wickliffe mill (an engineer by profession), the high costs of pollution abatement had placed the industry's marginal plants in an untenable competitive position. Himself once maintenance supervisor at another Westvaco plant, the manager's own experience reinforced his thinking about multicraft maintenance. He knew that workers can often contribute more than management realizes. Furthermore, he felt that "precise" or highly specific job classifications were counterproductive. (During a cutback in output at another mill, when maintenance personnel with high seniority "bumped" other workers, he learned that riggers with 20 years of experience in the one job could also be used in other jobs.) Finally, he concluded that "some workers enjoy more responsibility," and should be given the opportunity to assume it. Some company and union officials were skeptical about applying the multicraft maintenance concept, but the president of the local union favored it on the basis of some previous experience with the innovation.

Although the Wickliffe mill was a new facility, management's practice of giving advance notice on new technologies was still relevant, because the corporation signed a three-year agreement with the United Paper-
32 workers International Union (UPIU) at the

start of production. Leaders of the union local said that the managers of a sizable public utility were having trouble shifting to multicraft maintenance because they had made the mistake of informing employees of the change in an impersonal manner. The local's international union had already shown itself ready to accept new technologies and adaptations to remain competitive; examples of such reforms found in the newer Southern mills included multicraft maintenance personnel and extension of the "crew concept" to a paper mill's operations and power and recovery phases.

Prospective workers were also informed in advance of any novel duties they would have and training they would require. This was particularly important because the great majority of employees turned out to have no experience in the enhanced requirements of the jobs.

Workers for the Enlarged Maintenance Job--The shift from single- to multicraft maintenance (the new position was called general mechanic, or g.m.) was the major manpower (as well as technological) change at Westvaco. Job applicants who were pipefitters, millwrights, machinists, or electricians were told they would have to become qualified multi- or four-skill craftsmen through retraining over an approximately three-year period, or nearly the amount of time it took to train for the initial specialty. While they were not expected to become full-fledged craftsmen in each occupation, they were to develop a high level of competence in various facets of each craft. 33

The position is described as one of keeping the mill operating. Immediate focus is upon equipment breakdowns and unscheduled shutdowns, but great emphasis is also placed upon preventive maintenance, corrective maintenance, and scheduled shutdown maintenance. The g.m. is expected to be able to do most assignments "from start to finish." While 8 to 10 workers are assigned to a crew which operates as a team, often only two mechanics work on a particular job and supervision is minimal. This is why "top notch, motivated people" are needed.

Westvaco had studied the experiences of other mills which had shifted to the g.m. position. These were not always successful; others succeeded only partially. Nor had all of those mills incorporated the four crafts, with the electrical or instrumentation elements excluded at times. Not even the international union was intimately familiar with the concept. So the shift represented a considerable challenge for the workers and the company. However, there were a couple of advantages. One lay in the fact that the mill was new and thus not burdened with a single-craft tradition. Another involved the need to deal with only a single union. (Some mills, including some Westvaco mills, have from two to four unions.)

About 95 percent of the aspirants for the position were single-craft mechanics from such varied industries as construction, automobile manufacturing, machine tool, and rubber manufacturing; most had worked in
34 maintenance departments, but only two came

from another paper mill. The age of those who agreed to the terms (which ultimately appeared in a collective bargaining agreement) ranged from 21 to 48, with the average 30 years old. According to the personnel manager, the relatively older workers were up to the challenge as long as they were reassured that retraining would culminate in job security. The importance of steady employment as a preeminent concern on the part of the workers (attested by the research director of the UPIU) cannot be exaggerated. Therefore, while the small work force made reductions unlikely, affirmation was needed that should any become necessary an effort would be made to handle them through attrition.

Possibly as many as 90 percent of the new workers were from the three-State area within 150 miles of the plant. However, some came from Detroit and even California; many of them had left Western Kentucky during the previous several years because good-paying jobs had been scarce and they had not wanted to settle for agricultural or other low-paying work. Now they were finding it inviting to move to financially rewarding jobs close to their original homes; some even took a cut in pay at the start.

The greater responsibility inherent in the multicraft job was apparently an important stimulus to many of the applicants. It was suggested that some of the original jobseekers had been motivated by increasing educational attainment which would mitigate against specialization and toward generalization, but this could not be verified.

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The wage scale was also probably an important consideration. The hourly wage rate for a single-craft mechanic was $6.64. After qualifying for a second craft, it rose by 31 cents; competence in a third craft brought another 31 cents. A mechanic qualifying in all four crafts was paid an additional 78 cents, for a final hourly total of $8.04. This was at least $1.00 higher than the specialized mechanic's rate in large nearby chemical plants. Under a contract effective July 1, 1976, hourly rates rose to a range of $7.30 to $8.84.

Up until the present, only one person accepted for the program was declared a failure, not because he was not "competent" but because he was an electrician who would not accept other job responsibilities. Nobody has quit the program voluntarily. Eight foremen, who were promoted from within, supervise the 70 mechanics. Of these, 67 have four skills; the other 3 are striving to master their final skills.

The risk associated with this innovation has apparently paid off. Some earlier doubts on the part of managers and craftsmen (some of whom were considered opposed to "change itself") have faded, and the movement to the multicraft maintenance system is now underway in Westvaco's other mills, including the original and largest mill in Luke, Maryland.

Retraining: Conversion of Specialists into Multicraftsmen--Retraining represents the actual nuts and bolts of the "technology,"
36 involving, as it does, the conversion of

specialists into multicraft maintenance workers. The retraining, or simply training, of specialists to be multicraft maintenance workers must not be confused with an apprenticeship, as a 1971 Westvaco booklet makes clear. The aims are to enable journeymen "...to progress to multi-skilled general mechanic status by capitalizing on the synergistic strengths and advantages...developed in becoming a practicing journeyman." A mechanic undergoing training is assumed to build on a common base of transferable skill--including the use and care of common hand tools and equipment of his craft; ability to read prints and measure; knowledge of mathematics; and familiarity with "industrial routines."

The training is basically OJT plus home study and is conducted under the direction of of a union-management training committee. During indoctrination, trainees are reassured that the program's requirements are not beyond a journeyman's grasp. Both the committee and foremen "monitor" the progress of trainees to assure OJT rotation in sufficient variety to make home study meaningful. (Foremen have needed considerable "training" to insure the program's success: initially foremen of the old school would not, for example, call on a person who is considered a millwright to perform a job normally handled by an electrician.)

Westvaco remains convinced that the best practical training is secured through OJT, and mechanics are expected to train each other in their specialties.

According to its developer (TPC Training Systems, Barrington, Illinois), the home study portion is not a correspondence course because trainees do not have a real waiting period for answers to questions and problems. It differs in another sense from a typical correspondence course because trainees can call upon their crew members when part of a course is not clear. Trainees take three 100-hour courses for which they are paid at the regular hourly rate upon the completion of each. The courses are described as "...new method/s/ of self-instructional training.... Short segments of easily understood text material are followed, and strengthened, by the latest programmed learning techniques." The home study approach is considered less "burdensome and disruptive" than classroom instruction which was used only during the start-up phase. It allows the trainee to proceed at his own pace. Periodic tests are administered by Westvaco's Personnel Department.

A journeyman beginning training spent about 70 percent of the workweek in a craft other than the one he was hired to perform and the remainder--nearly 15 hours--consisted of OJT. Those who were not qualified welders also had to enroll in a full-time 80-hour course at Paducah High School (for which the company paid) and finally "tested" by Westvaco welders. The company now conducts welder training as needed as part of its own OJT.

Even if they are not in the current "pri-
38 mary" craft for which a trainee is taking

OJT and a correspondence course, tasks in any of the trainee's "blue booklets" are approved as they are completed. Thus training tends to become easier after the second craft is added. (Exhibit 1 is a typical page from a a mechanics training booklet. Exhibit 2 is a brief record of all g.m. requirements.) The approach to journeymen not hired as electricians is basically not different, although this posed the biggest problem because of safety considerations. However, enough knowledge and understanding of the basic elements of the craft could be imparted to avoid hazardous situations. The mill manager said he became convinced that the electrician craft could be included in the g.m. classification when he observed two mechanics working on a high overhead crane under extremely hot conditions. One of the mechanics had an electrical background while the other did not; however they took turns working at the great height and completed the job satisfactorily.

Exhibit 1. Typical Page, Craft Training Checkoff Book, Westvaco, Wickliffe Mill

MILLING MACHINE - MILL, PLAIN

THIS REQUIREMENT HAS BEEN SATISFACTORILY MET

DATE:_____ APPR. SIGNATURE: _____

TO: MAINTENANCE TRAINING RECORDS CLERK:

PARTICIPANT	DATE	APPR. SIGNATURE

DESCRIBE JOB: _____

NO. MEN ON JOB:

CRAFTS PRESENT ON JOB (X):

MILL-WRIGHT	ELEC-TRICIAN	MACHINIST	PIPE FITTER

CAPACITY OBSERVED IN (X):

INDEPENDENT	LEAD	LEARNING

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Exhibit 2. Master Record, Multicraft Maintenance Training Program, Westvaco, Wickliffe Mill

NAME _____ CLOCK NO. _____ SENIORITY DATE _____

Welding	Prequalified	.	
	Completed	.	_____Date___Book No.
		.	
Millwright	Prequalified	.	
	Home Study	.	_____Date
	Classroom & OJT	.	_____Date ___Book No.
Electrician	Prequalified	.	
	Home Study	.	_____Date
	Classroom & OJT	.	_____Date ___Book No.
Machinist	Prequalified	.	
	Home Study	.	_____Date
	Classroom & OJT	.	_____Date ___Book No.
Pipefitter	Prequalified	.	
	Home Study	.	_____Date
	Classroom & OJT	.	_____Date ___Book No.
Final Training Completed		.	_____Date
Certificate Awarded		.	_____Date

Among training aids utilized are mockups, models, slides, films, and recordings. Also used is a Carmody Process Trainer, which simulates the control panel in paper production. In addition, the Personnel Department is developing a library of slides for all of the mill's processes.

On the average, it has taken a journeyman 12 months to complete each additional craft. A minimum of 6 months and a maximum of 15 is set for completion of the first craft. Six-month extensions are made for the second or third crafts, if needed.

Mechanics, as well as other workers, are shown films on changed equipment and processes. A course in pneumatics and hydraulics is also under consideration. Westvaco has a policy of paying for job-related courses in electricity, air conditioning, and other fields. And the union is very supportive; according to the union president, "We like to think that our mechanics always stay in training."

Changes in Job Classifications--Other shifts away from traditional job classifications have also occurred steadily at the Wickliffe mill, with multiple skills in a crew leader concept working well in the pulp mill, power and recovery, woodyard, pulp dryer, and shipping departments. As with maintenance, no specific job titles are applied to machine operators. Such designations as "crew leader" and "assistants" are used to encourage workers to think of a whole operation rather

than its pieces, and workers in the crews (teams may be a better term) function as a unit. In general, the absence of specific job titles can be interpreted in terms of "minimum manning."

According to the mill manager, the crew leader concept in other departments reinforces the multicraft maintenance system. However, while the two types of job classification and organization should ideally go together, he cautioned they can be "difficult to bring off." The concept is more difficult to apply in the paper mill, where some old job titles remain, although all opportunities to assure success may not have been exploited. The crew in the pulp mill is made up of the crew leader, assistant crew leader, first, second, and third assistants, and reserve.

Crews for production and power and recovery were required to have more knowledge of paper technology than maintenance crews: crew leaders and assistant crew leaders with paper industry experience; first and second assistants with "related experience"; and third assistants and reserves from among promising job seekers in "the area." Two-thirds of the workers in the power and recovery department had previous experience within the industry. Those numerous workers with no previous employment in paper manufacturing had to be taught all phases of the job as well as indoctrinated in the crew concept (which was particularly important for those crew workers who had been content to
42 do a single job before).

The change in working arrangements is particularly striking within the power and recovery department, where all crew workers function cooperatively within the same control room. (Older mills might have five control rooms and separate job classifications. Better instrumentation has allowed all operations to be observed from one control room.) The crew has considerable responsibility. It maintains the filtered water, fire system, two power boilers, central air conditioning, distilling plant, waste treatment, evaporators, recovery boiler, lime kiln, caustic lignin works, and electrical distribution. It has no supervision at night. Training was described as being "continuous," with virtually all of it on the job although classroom instruction takes place before new equipment is added. The simulated control room is "about as close to the job as you can get."

The crew leader and multiple skills concepts have influenced all segments of the mill. Thus, whereas general service workers (or the yard crew), who are under the supervision of the maintenance department, are classified at other plants as laborers, backhoe operators, truck drivers, etc., they perform all of these jobs plus cleanup for maintenance personnel at Wickliffe. According to the mill manager, this has been the only area with some problems of jurisdictional definition, since "reserve" workers within the various departments with the crew concept do not have well-defined duties and mainly fill in for absent or vacationing workers. However, the reserve worker moves

into a job vacated by the lowest working assistant.

Production personnel at Wickliffe perform minor maintenance and lubrication willingly and routinely, jobs they would not do in a more traditional plant.

The pulp mill crew leader claims he can now perform a supervisor's job at least as well as an actual supervisor. However the supervisor's job has changed: since multicraft mechanics usually do not need the advice of supervisors, the supervisors perform various coordinating functions to smooth work movement.

Even the clerical force has undergone changes, which are somewhat analogous to those experienced by maintenance and production workers. Now only two people have their own secretaries: the mill manager and the personnel director (for dealing with confidential matters and fringe benefits, which are considered "technical"). A pool of secretaries, typists, and stenographers handle the work of everyone else, including the personnel director's nontechnical work.

Changes in Employment, Production, and Productivity--The other mills within or outside of the Westvaco system do not have the same level of automation and the exceptionally fast papermaking machine as Wickliffe. Nor do the others have a fully operational four-craft maintenance system, the crew
44 leader concept in various departments, and

other innovations whereby job classifications are thinned. Such variations can, to a considerable extent, account for differences in employment, production, and productivity of Wickliffe as compared to the other mills. However, some approximate comparisons are valid.

The Wickliffe mill has 330 hourly employees and 130 salaried employees. About 600 tons of pulp are produced daily; from this 350 tons of paper are manufactured daily. (This is "fine paper"--light weight, bleached white, all pulp, and weighs 40 to 80 pounds, or 40 to 80 pounds per 1,000 square feet.) The 250 tons of pulp in excess of the mill's needs are sold to other firms. Paper manufacturing resembles a steel mill with respect to continuity of operations; three shifts run throughout each 24-hour day and four crews work on a rotation schedule.

Using an admittedly crude measure of tonnage per employee, the personnel manager estimated that productivity at Wickliffe is 75 percent higher than at an older mill. Specific credit is given to the four-craft maintenance system, without which, the mill manager said, "at least twice as many" mechanics (140 instead of 70) would have been required.

The president of the union local expressed definite and positive views independently of but coinciding with the mill manager. "If we're going to be competitive around the world, we have to be productive," he said. The union president compared the performance of a Georgia mill with which he was 45

familiar with the Wickliffe mill. Wickliffe operated with slightly over one-quarter of the workers per shift in Georgia and produced nearly twice as much.

Higher productivity resulting from labor savings was, a supervisor claimed, even more evident in the power and recovery department than in maintenance. He cited another paper mill's department which had more than three times as many men as his department and produced only about 35 percent greater output.

Labor and management representatives often observed that workers only become efficient if they work as a team and complete a given job. Worker rotation from one team to another does produce an initial "blip," or temporary decline, in efficiency, but this quickly disappears and "overall" efficiency becomes greater. Surprisingly, because they have greater understanding and are able to relate various processes, crew members may even outperform highly specialized workers on their own specialties.

G. m. 's are likely to solve problems more quickly because they become "superior troubleshooters" able to consider all facets of a problem. Morever, since they all work together on a job, the downtime clocked by specialized workers waiting for each other to complete a part of the work is eliminated. Thus, instead of requiring the services of five men to remove a pump, only two or three g. m. 's are needed--and nobody would
46 be waiting around. Improved scheduling is

also possible because task assignments can be made with flexibility; that is, any two workers can be selected for a task requiring two workers. Scheduling improvements plus downtime savings yield from 25 to 40 percent in time gain. Also ended are the vexing jurisdictional disputes so often associated with maintenance and which sometimes result in "one union being played off against another."

Effects of New Technology on Workers--Jobs are less strenuous but demand more responsibility. Workers were more interested in and gained greater satisfaction from knowing an entire process. 1/ As one of the g.m.'s said, "Sure, some work is liked more than other work, but the variety makes the overall job enjoyable." Moreover they were pleased that they could initiate their own ideas and that their supervisors were accessible to them. As team members, the mechanics exhibited a generosity in sharing their know-how, including willingness to train others. They are also eager to expand their know-how: many workers indicated interest in a voluntary correspondence course in pulp and papermaking. 2/ Their pride in their own accomplishments is reflected in a concern that competent people be hired to work with them. Production workers within the crew concept are also found to be more knowledgeable; as a result, g.m.'s need talk to only one or two to get a lead for solving production problems.

Greater flexibility in assigning jobs made for a more equitable allocation in overtime, vacation schedules, and other benefits. The

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low 3 percent mill-wide absentee rate is even smaller for maintenance workers. (Some expected absences occur after a worker has been on the job for a period well beyond the normal workday.) A turnover rate of only 1 percent was recorded for g.m.'s The paper industry as a whole has a high accident rate; however, accidents are fewer among multicraftsmen because they "know the flow of things and are more relaxed" and mistakes are less likely. Working together, workers communicate more and feel a responsibility for each other. Most grievances relate to overtime work; these are likely to arise equally with multi- or single-craft mechanics.

The personnel manager also feels it is now more likely that young workers can be attracted to jobs involving the multicraft and crew concepts.

Chapter 3. Footnotes

1. At a Topeka, Kansas, General Foods plant, learning various jobs was considered the "key to job satisfaction." Reported by James O'Toole, "The Reserve Army of the Underemployed: II--The Role of Education," Change, Vol. 7, No. 5, June 1975, p. 33.

2. At the General Foods plant, a company offer to pay for "any course any...employee pursues in his or her spare time" met with three times as much worker interest than in all of the other firm's plants. "It appears that learning on the job /in particular, learning all phases of a job/ has whetted the workers' appetite for more education." J. O'Toole, op. cit., p. 60.

CHAPTER 4. INSTITUTIONAL RETRAINING OF GRAPHIC ARTS WORKERS

The Chicago Graphic Arts Institute, a joint employer-union operated training institution, is an example of the decided shift in the industry from training young apprentices to retraining middle-aged workers. This can be attributed to technological and locational changes.

The U.S. Department of Labor reported in March 1976 that in the graphic arts, which is dominated by the printing industry, the number of registered apprentices had declined from 14,000 to 13,000 between 1964 and 1974, largely as the result of "automated techniques." Emphasis upon retraining has been relatively greater in the Chicago area than in other communities because several larger employers moved to the South, a shift facilitated by retraining (and even initial training) provided by equipment manufacturers.

Organization, Objective, and Funding--The institute was founded in 1922 and is the oldest and largest school of its kind in the country. Its "modern history" began in 1946 and coincided with the onset of sizable technological changes. In 1971 it occupied a new 22,000 square-foot building.

The institute's objective, as stated in the Program of Instruction, reads: "The ever-increasing technological advances in our industry have emphasized the need and real value of a formal educational program." [51]

Formal training makes it possible for problems and processes not met in "daily work" to be handled and does not substitute for OJT.

The institute is operated as a nonprofit trust. Represented on the board of trustees are the Graphic Arts International Union, Chicago Local 245, and four employer associations--Chicago Lithographers' Association, Chicago Photoplatemakers' Association, Chicago Rotogravure Association, and Chicago Newspaper Publishers' Association. (The International Graphic Arts Union resulted from a merger of the Lithographers, Photoengravers, and Bookbinders. Recently membership in the divisions for the U.S. and Canada was 40,000, 15,000, and 58,000 respectively; 33,000 women are members, mainly employed in bookbinding where large-scale equipment has not yet been introduced to replace labor.) By sheer weight of numbers, the large-scale printing establishments and their unionized workers avail themselves the most of the institute's services; however 180 firms and approximately 6,000 members of the union local may participate in the school's training.

The institute is funded by employers through contract negotiations with the union. Their employees who are covered under the agreement can enroll for courses at no additional cost. Other workers currently employed in the graphic arts can take courses but must pay tuition. Depending on the subject, tuition ranges from $100 to $300 for three hours of instruction, once weekly, for 10 to 17 weeks.
52 Less than 10 percent of all students have been

tuition-paying and 80 percent of them have had their tuition paid by employers. According to the institute's director, enrollment is limited to persons with experience in the industry because employment prospects are limited. Young persons with "no ties in the industry" are urged to enroll in a community college program or else secure some industry experience first.

Student Body--Students are largely from the Chicago Metropolitan Area, although small groups have been enrolled from throughout the country. Less than 2 percent have been from foreign countries; less than 5 percent are women. A special short course in lithography is offered each year to half a dozen men and women in middle management, sales, or purchasing with such corporations as Time-Life, Encyclopedia Brittanica, and American Can.

The former emphasis on apprenticeship is losing out to retraining. In the immediate postwar period, when lithography was booming, 98 percent of the students were enrolled as apprentices. Even as recently as seven years ago, about 90 percent were apprentices. However, by 1974-75, only 40 percent were apprentices. Two kinds of retraining accounted for the other 60 percent. The figures broke down as follows:

Retraining		403
For upgrading	261	
Associated with technological change	142	
Apprenticeships		274
		677

The institute's director agreed that the distinction between training for upgrading and training associated with technological change was not always as clear-cut as these figures might suggest. Retraining for upgrading could broaden skills and insulate workers against the dislocations of technological change.

Journeymen undertake retraining voluntarily and are not paid for time in training. Those who are employed attend before or after work; night-shift workers from 10 a.m. to 1 p.m.; day-shift workers from 5 to 8 p.m. Some 97 percent complete their retraining. According to the director, age has posed no obstacles to training.

Broad Technological Change--Within the three printing processes--letterpress, lithography, and gravure--there are 30 specialized fields in which technological change may be so substantial that a field "virtually ceases to exist." The education director of the union's international, headquartered in Washington, felt that a "cresting of technology" has taken place. The director of the institute described the shifts in technology as
54 a rather constant occurrence which resulted

in certain workers being "in jeopardy at most times." He noted, however, that changes may be "quite gradual": 10 years passed before the marketing claims for electronic scanners were realized. Moreover, for several technological changes retraining may have been required but employment did not necessarily decline.

As in other industries, routine jobs are the first to be affected by new technology. For example, diversified cameramen who then became specialists in film contacting would be out of luck today because at least in the Chicago Area few jobs are available in only that specialty.

Three technological changes have had a major impact in recent years on employment and required retraining. First is the replacement at a steady pace over the last 15 years of letterpress by lithography. According to the institute's director, "Letterpress is dying because it's labor-intensive." The great majority of small newspapers are now produced by lithography. The major newspapers continue to use letterpresses only because of their sizable investment in machinery; but as the machinery becomes inoperational or too costly to operate, it is often replaced with lithographic equipment.

The second key technological change involves the shift from sheet-fed to web-fed lithography, an innovation which affects nearly every process. Thus it made it possible to do color separations much more inexpensively by electronic scanners, instead of by more 55

labor-intensive photo-mechanical methods. However, as a result, color might be used much more in printing, including newspapers, with employment maintained at approximately the same levels. However, overall employment decreased sharply in a large firm which shifted production completely from sheet-fed to web-fed lithography presses. The number of presses and employees declined "significantly," but productivity rose "significantly," although the exact figures are disputed.

The third major improvement involves lithographic platemaking. This was described as having a "devastating" outcome because many workers have had to be retrained in other areas.

A fourth new technology still at the frontier is rotogravure. Commonly referred to as "fantastic" and a "sleeping giant" the process may be in wide use in the next decade. It is costly, however, because a chrome-plated copper cylinder is needed. A great advantage is the ability to print on the lightest paper stock. All major catalogues, newspaper supplements, and long-run magazines are done by the process.

Retraining for Skill Obsolescence--The Graphic Arts International Union and most of its locals (including Chicago) recognize that the well-being of both the industry and union members depends upon developing and applying new technologies. However, the international also suggests that bargaining agree-
56 ments include a clause referring to the

companies' responsibility to "explore and promote new markets" to assure employment. In addition, 300 locals have succeeded in incorporating a "New Machines or Processes" clause which requires 90 days advance notice before adoption of any new equipment or process, and prior agreement on "manning," wages, working conditions, and training and retraining of any affected workers.

In 1955 the institute retrained hand proofers to work on power-proofing machines. All were over 40 years old but "had a strong motivation to retrain because of accumulated skill, experience, and /a history of/ favorable wages and health and welfare benefits." Workers are now being retrained from sheet- to web-fed presses. Many photoengravers whose main employment has been as platemakers for the letterpress industry, have been retrained to gravure and lithographic offset positions.

Institute Meets Needs of Trainees--According to the director, a "whole study" could be made about why trainees enroll in the institute. Their reasons include diminishing demand for a craft; preparation for a supervisory position; displacement due to technological or other causes; physical difficulties, such as inability to tolerate solvents in the pressroom, dermatitis, respiratory ailments; or simply the opportunity to meet other workers and exchange ideas and work methods.

Because enrollment at the institute is completely voluntary, motivation tends to be high. In fact, instructors prefer volunteer journeymen as students over "captive"

apprentices. Some workers enroll for training even before the union is informed about a technological change. This may reflect the good communication between managers and their highly skilled and relatively small work forces. Maximum enrollment at all times primarily results from word of mouth reports by students convinced of the worth of the retraining.

The trend now seems to be away from narrow specialization, and unemployed specialists invariably enroll in retraining programs to broaden their skills. However, many trainees do not need retraining. They have well-rounded skills and considerable experience, but jobs are unavailable and "they are going through emotional upheaval." In general, corporate printers want "sophisticated specialists," small printers "combination men" or generalists.

In most cases, trainees are encouraged to enter parallel fields. For instance, the same basic background is required for whatever different etching techniques that are used. However, sometimes difficulties arise. Chicago platemakers at Continental Can Corporation were laid off when a new technology was introduced and production was consolidated in New Jersey. Before these workers could be retrained for similar work they had to be taught the differences between working on paper and cans. Furthermore, off-the-job instruction was preferable to OJT, which would require an admission on the part of these "proud men" that their years of experience only applied to can labels.

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Instruction--The institute has three full-time supervisors and 20 to 25 part-time instructors for each of the supervisor's departments. The number of part-time instructors is large for several reasons. Pay is little ($10 per hour), not enough to warrant full-time work. In fact, considering course preparation, travel, and overtime, instructors can almost be considered volunteers. Furthermore, a one- or two-course teaching load does not interfere with home life. In addition, instructors are actively engaged in the subjects they teach and are thus more credible.

The international union's Education Department holds annual seminars for instructors and develops and distributes training manuals and course materials. The institute also sponsors teacher seminars.

Lectures, an audio-visual room, and the library are used, but the principal emphasis is "hand on," or practical instruction. Classes are small--from 4 to 10 students.

The institute must have elaborate and costly equipment for the bulk of its activities; for example, the automatic film processor which is widely used in the industry. However, it also needs nonautomatic equipment in order to help students understand what the automatic machine "is actually doing."

Equipment valued at about $1.5 million is on loan to the institute, the result of good relations with manufacturers and the interest

of suppliers in keeping instructors abreast of the latest equipment and processes. More than 80 percent of expendible supplies are also donated. All told, more than 100 large and small firms have made loans or gifts to the institute.

CHAPTER 5. INSTITUTIONAL UPGRADING OF WELDERS

AIRCO Technical Institute in Baltimore is the third welder training school established within recent years by AIRCO, Inc. (formerly Air Reduction Co.). The company, founded nearly 60 years ago, has annual sales of almost $1 billion and employs 14,000 persons in several manufacturing divisions. AIRCO is one of the Nation's largest manufacturers and marketers of welding equipment and supplies for the metalworking industry.

An article in Iron Age 1/ outlined the industry's welder training as follows:

1. Companies like Caterpillar Tractor and Chicago Bridge and Iron train their own welders.

2. Welding manufacturers, such as Lincoln Electric Co. and Hobart Brothers Co., have had welder-training schools for many years. For example, the Hobart Welding School in Troy, Ohio, was established in 1930 when arc welding was a relatively new fabricating method. The school runs 52 weeks a year, and offers courses to teachers in the summer.

3. Small fabricating firms do not usually do their own training.

AIRCO had more than 50 years experience in training welders before it established 61

institutes to train welders for others, and purchasers of the company's equipment can still be trained at the California, Texas, Illinois, and Pennsylvania sites. This ranges from 1 week for general exposure to 10 weeks for learning a new process, with trouble-shooting and preventive maintenance requiring around 5 weeks. The Education Division was established to alleviate a serious and enduring shortage of trained welders, a function which neither public nor private educational and training institutions were able to do. By training welders in the most advanced techniques, the company also recognized that more opportunities would be opened up for mid-skill and entry-level welders; in fact, the first AIRCO Technical Institute, which was initiated in Cleveland in November 1968, focused on this under a subcontract from the city's Concentrated Employment Program.

At an early stage, the institute was placed in the corporate structure so that it would be judged, as any other operation is, on the basis of performance. The head of the Education Division is also an assistant to AIRCO's chairman.

A second training center was established in Brooklyn, New York, late in 1971. The Baltimore institute, which is the subject of this case, was established in July 1972. A fourth institute was established in Newark two years later and two more were operating in
62 Pittsburgh and Philadelphia by mid-1976.

Employment and Technological Outlook in Welding -- The employment outlook for welders appears to be favorable. (Jobs are also available for welding engineers, who are metallurgical engineers with a practical knowledge of welding. However, the job description is vague and it is difficult to attract people to it.) Iron Age reports "a critical shortage" of top-level welders in the face of heightening needs: such growth industries as energy, transportation, and food are "welding intensive," in terms of the pipelines, pressure vessels, ships, railcars, and tractors that will be required. 2/

Most of the unemployment among welders is due to their being "too limited in what they can do," according to an AIRCO representative. Thus, the maximization of employment opportunities and upward occupational mobility is dependent on developing enough highly skilled welders. A recent president of the American Welding Society attributed the shortage to "...top management's lack of concern for competent, capable people." Supervisors were also cited as having insufficient skills and the inability to learn from the workers. According to one AIRCO educator, the important thing in supervisory training is to teach supervisors how to get workers to produce more, which might involve learning how to operate a supervisor-worker committee. "After all, workers talk about their jobs even during work breaks."

While all known forms of welding are still in use, a marked shift toward the "semi-automatic" process has taken place in recent

years. Gas (or OXY-fuel) welding is the first to have been widely used. ARC welding, which requires equivalent skills to gas welding, is used to obtain higher quality welds; it has attained a major position in welding. MIG (or Metal Inert Gas) welding, which is considerably faster and more easily learned than ARC welding, is the first semi-automatic process and is widely used compared with 10 years ago; a comparatively new process, it could lead to a substantial expansion in metal fabrication because of its great usefulness on heavy metals. According to AIRCO estimates, ARC welders are 10 times as plentiful as MIG welders, and employee resistance to the new MIG welding has led some companies to postpone its adoption. TIG (or Tungsten Inert Gas) is another new form of welding whose use has increased greatly in energy-related jobs, including pipeline systems demanding zero defects. Nuclear Pipe Welding is a tedious process that requires very high caliber craftsmen and expensive equipment; ultimately the process will be made more productive, and while it is more costly than other forms of welding, it meets environmental standards.

Certification of Welders--Finding a more efficient way to certify welders is a challenge, which, if it can be resolved, would result in higher welder productivity.

Considerable duplication is involved in the tests and standards applied to welders. Because there is no "cross certification," a welder trying to qualify for a very demanding
64 position too often must submit his welds to

the standards of the American Society of Mechanical Engineers, the American Welding Society (AWS), the American Petroleum Institute, the U.S. Bureau of Ships, and the U.S. Coast Guard. In addition, a contract may specify that welders must be certified at three-month intervals for various processes unless these have been utilized during the period. Recertification is also required when welders shift to other employment. Moreover, well over 50 percent of applicants for certification do not pass the tests.

AWS is troubled that the costs to the industry of administering the testing are over $100 million annually. AWS has been preparing a procedure for nationwide certification, an onerous undertaking since no generally accepted task analysis of welding exists. (A survey by the AWS Educational Activities Committee revealed that companies employing welders utilize hundreds of different job descriptions.) In providing the guidelines for a job description, the AWS decided two sections would be required: "One section should describe the normal technical requirement to make welds of prescribed types and the other section should describe the working conditions of a specific job." 3/ Thereafter, the content and mechanics of training can be based upon the requirements of the industry or government agency. (Canada has an on-site welding certification program. 4/) AWS, which already prints standards for welding, and is considered to be an authority by the Energy Research and Development Administration, has announced plans for "qualifying and certifying" welding

inspectors in all of its 21 districts, which cover the entire U.S. The process will include a closed book written test on fundamentals of welding inspection and an open book written test on codes and standards. 5/

Retraining -- Since the Baltimore AIRCO institute has been primarily involved in training entry-level craftsmen, the retraining activities at the Cleveland and Brooklyn institutes are discussed as well as those of another institution, the Lincoln Technical Institutes.

Retraining to upgrade often takes place at a "point of crisis"; that is, when "new job demands" are made. Retraining to upgrade cannot always be distinguished from retraining to adjust to technological change, although the latter need not be undertaken under crisis conditions if a technological change is announced in advance.

Retraining to adjust to technological change was first undertaken by AIRCO in Cleveland in 1970, two years after the institute was established. Retraining involved (1) Babcock Wilcox; (2) Republic Steel (preparing welders to meet certification standards); (3) Barth Corporation (making employees "more versatile" by upgrading and teaching them to read blueprints); and (4) a local plumber union (teaching members upgraded welding skills).

The Brooklyn institute, which has an X-Ray laboratory that evaluates the quality of welds under stringent conditions, also has
66 retrainees. The Brooklyn Union Gas Company

has sent its welders there to learn how to work on heavy pipes--to perform downhand pipewelding, major branch connection welding, and fitting operations for new pipeline systems. The institute has also prepared for certification pipewelders of two mechanical contracting firms.

The Baltimore institute developed a program which is training about 70 unskilled longshoremen in welding and, when needed, basic mathematics and reading. The program was instigated by the International Longshoremen Union after a State of Maryland study determined that container repair was important for longshoring. Since the containers had to be sent to Newark for repair, the State agreed to help pay for the training. The course runs 12 weeks and includes classroom instruction, demonstrations, laboratory work, and OJT. If the supervisor considers it necessary or desirable, training is given in additional skills. Workers who know how to weld are offered an intensive course in MIG welding on Saturdays.

AIRCO was selected by State and local manpower and education officials to prepare a course to train maintenance mechanics in diversified skills, including upgrading their welding skills. A 600-hour, 16-week course of full-day instruction was instituted in the summer of 1976 to teach mechanics to deal with different metals, welding processes, and procedures. The hope is that multicraft mechanics will result in a decrease in wasteful downtime (one benefit enjoyed by Westvaco as the result of developing four-craft maintenance mechanics).

AIRCO would like to provide training in such growing fields as nuclear process welding, industrial radiography, and shipfitting but feels that in view of the prohibitive costs of equipment and supplies alone, cooperative agreements with government and private industry would be necessary.

The Lincoln Technical Institutes--The president of the Lincoln Technical Institutes was instrumental in establishing the National Association of Trade and Technical Schools (NATTS) in 1965 and served as its first president. NATTS was founded primarily to gain accrediting authority and thereby raise the standards of private vocational schools. NATTS was designated an accrediting agency by the U.S. Office of Education in 1967 and has since accredited more than 300 schools.

Lincoln enrolls trainees of a company on an individual basis. New classes are convened at frequent intervals. The schools operate year-round and classes are conducted day and evening.

Lincoln, as most other private vocational schools, mainly trains students in a first or new occupation. However, Lincoln has also retrained hundreds of people. Beginning on page 70 is a sample of Lincoln's sponsoring agencies and courses.

In the case of the New Jersey Department of Labor and Industry, 20 people were enrolled in late 1975-early 1976 when RCA Industries and Anaconda closed some plants or moved them abroad because they could not compete with foreign manufacturers. Laid-off workers with no marketable skill were eligible for retraining under the Training Rehabilitation Act (Trade Expansion Act of 1962). Trainees are between 40 to 50 years old; all had between 15-25 years of service.

In accordance with the tendency of private schools to anticipate future needs, Lincoln is considering a retraining program in solar heating and cooling, with a firm decision about three years away.

Training at AIRCO -- At its formation, AIRCO's Baltimore institute established an association with the large Bethlehem Steel facility at Sparrows Point. The Bethlehem-AIRCO "marriage" resulted from a conversation between the top managements of both corporations which took place in 1971 when Bethlehem found a shortage of the third class shipyard welders and shipfitter handy men which it needed in large numbers. Tuition costs for the 13-week courses were largely defrayed by the Department of Labor, with Bethlehem having paid the remainder when a person met the company's skill requirements. The experience made AIRCO, Bethlehem, and the industry into "believers" that unskilled workers can be trained as craftsmen. Since 1972, some 900 AIRCO-trained welders and shipfitters have been employed by Bethlehem.

Selected Instances of Retraining at the Lincoln Technical Institute

Location of Institute	Firm or Agency	Course
Washington, D. C.	Washington Suburban Sanitary Commission	Automatic transmissions
	U.S. Department of Agriculture	Air conditioning-refrigeration and heating systems
	Federal Aviation Administration	Automotive air conditioning and automatic transmissions
	U.S. State Department	Automatic transmissions and automatic air conditioning
	NASA	Automatic air conditioning

	D. C. Department of Environmental Services	Basic auto mechanics
Baltimore, Md.	Maryland National Guard	Air conditioning
	Maryland Gas and Electric Company	Auto transmissions
Philadelphia, Pa.	Rohm and Haas	Automotive diesel technology
	Temple University	Automotive technology
	Pennsylvania Truck Lines	Diesel engine
Allentown, Pa.	Philco-Ford	Electronics technician
	General Electric	Special basic electronics

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Selected Instances of Retraining at the Lincoln Technical Institute (cont.)

Location of Institute	Firm or Agency	Course
	Apollo Metals	Special basic electronics
Pennsauken, N.J.	IBM	Electronics
	U.S. Army	Court reporting
	Campbell Soup	Drafting
	RCA	Drafting
	Penn Walt Corporation	Air conditioning-refrigeration
	Rohm and Haas	Air conditioning-refrigeration
	Federal Aviation Administration	Air conditioning-refrigeration

	Valley Oil Co.	Air conditioning-refrigeration
	Temple University	Air conditioning-refrigeration
Union N. J.	New Jersey Department of Labor and Industry, Division of Unemployment and Disability Insurance	Air conditioning-refrigeration and heating systems Air conditioning-refrigeration servicing Engine tune-up
Dallas, Texas	W. J. Thomas Line Builders	Diesel engine
	Mustang Rebuilders	Diesel engine

Private vocational schools such as AIRCO's must obviously be concerned with their graduates' performance on the job, since word of mouth by satisfied students is a main means of attracting students (as the Chicago Graphic Arts Institute found). AIRCO trainees invariably enroll voluntarily and therefore must be convinced that their time and effort will be recompensed. Moreover, AIRCO trainees often pay their own tuition and are even more likely to hold their training responsible for the caliber of their job performance as perceived by employers. Not surprisingly, a training institution such as AIRCO is convinced that persons trained off-the-job will perform better than those trained on-the-job. OJT, AIRCO argues, must be accomplished at the same time that "production is delivered; since a supervisor is responsible for production, he cannot be a thorough full-time teacher and evaluator of the results of training."

If in conjunction with an employer who would provide the OJT portion of the training AIRCO were to be responsible for related instruction, it would insist upon "carte blanche to work on a performance basis," in order to assure quality control (as in the arrangement to train longshoremen in Baltimore). AIRCO feels that workers in industrial plants need "more and better" counseling which, if necessary, should be secured by contract and presumably on the basis of performance. (Sometimes supervisors are threatened by training and retraining and fail to encourage workers to avail themselves of such

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opportunities. For its part, AIRCO has experienced counselors to aid students with personal problems and a job placement service.)

AIRCO's training simulates the employer's actual working conditions not only in terms of work spaces but also in actual discipline and operations. For example, trainees who fail to punch in and out on a time clock are counted absent. The school is open between 7:30 am and 10 pm.

The Baltimore institute is a single-story industrial building containing 20,000 square feet. More than two-thirds of the space is devoted to the practical phases of welding, fitting, and associated skills. The largest part of the expansive shop area comprises 124 welding booths to allow trainees to progress at their own rate. Each booth has at least one transparent side to enable instructors to observe and give individual attention. Each welding machine houses an odometer which evaluates the quality of welds and measures productivity. If necessary, instructors teach beyond the required hours or employ "other corrective action" so that undesirable techniques do not become ingrained.

In order to teach the fabrication of large weldments, a specially equipped outside area consists of an 8,000 square foot steel platen area and two 24-foot high bulkheads for fitting and welding practice at heights and on scaffolding similar to that found in the shipbuilding and construction industries. 75

Lectures and group instruction are offered on basic theory, job requirements, and safety. All theory "must relate" to hands-on training. Most courses are based on a six-hour day, five-day week. Part-time schedules of a minimum of three hours per session can be arranged. Classrooms accommodate a maximum of 30 students.

The major courses cover:

1. ARC welding

2. Combination welding, including OXY-fuel, ARC, MIG, and TIG welding.

3. Comprehensive course (650-700 hours), including everything in 2 (above) plus testing, basic machine maintenance, and extensive instruction in evaluating blueprints.

The testing component in 3 (above) refers to the student's learning how to perform metallurgical evaluations of welds, which, according to AIRCO, "builds qualitative control into the individual and makes him more productive." In general, the comprehensive course contains more theory than the other courses and teaches more about "why something is done." High school graduation is required and the course is "primed" for further instruction and ultimate identification with the occupation of technician.

Trainees are primarily from Metropolitan Baltimore, but some in upgrade training come
76 from within a 50-mile radius. Tuition covers

all AIRCO expenses. About 40 percent of the trainees pay their own way, with some using the Basic Educational Opportunity Grants from the U.S. Office of Education. Typically these self-paying students are trying to find a place in the industry and usually enroll for a 13-week course. AIRCO educators believe that older workers should not be treated differently, or else they will "act differently." Older workers can help younger workers to learn "job discipline" and industrial standards. Some older workers may need slightly extra instruction in blueprint reading.

AIRCO prides itself on the rate at which students complete training. Under a contract for full-time training with the City of Baltimore financed under the Comprehensive Employment and Training Act (CETA), about 85 percent completed either a combination welding or shipfitting course. Non-CETA students in the combination and comprehensive courses have had an even higher completion rate--nearly 95 percent. Part-time students, representing about one-third of all, are usually already employed as or else want to become welders; their completion rates are lower, but still around 80 percent.

All AIRCO instructors have "extensive" experience. About 90 percent instruct full-time, with the remainder permanent part-time employees of the institute. New instructors are trained in teaching methods and instructors upgrade training on a continuing basis. Instructional materials of Purdue and other universities are used. One instructor teaches at a university for short periods

each year and then shares with the others new training materials and approaches. Instructors are paid at a higher rate than experienced welders in manufacturing.

Chapter 5. Footnotes

1. N. B. Schwartz, "Welders Train to Fit Industry's Needs," Iron Age, April 9, 1970, pp. 71, 75.

2. "Shortages Push Welding to Turn Things Around," Iron Age, March 31, 1975, p. 37.

3. H. B. Cary, "The Job of the Welder," Welding Journal, January 1975, p. 12.

4. "Shortages Push Welding to Turn Things Around," Iron Age, op. cit., p. 45.

5. As outlined in Guide to AWS Welding Inspector Qualification and Certification, Miami: American Welding Society, 1976.

CHAPTER 6. RETRAINING BUILDING INSPECTORS IN LOCAL GOVERNMENT

Detroit was stimulated by a crisis to institute combined housing inspections by its Building Department. The program, which was planned with dispatch, shifted from separate inspections by specialists to four-in-one inspections (electricity, heating, plumbing, and overall building structure inspected by one person).

This four-in-one form of inspection, with its job enhancement, is, in this case, the technology whose adoption was made possible by retraining. This technology is used in many cities much smaller than Detroit as well as in counties encompassing large geographical areas. These adopted the technology because they could not afford the expense of many specialized inspectors versus fewer four-in-one inspectors. Thus, Rocky Mount, North Carolina (population 35,000) retrained inspectors to perform all inspections (plumbing, electricity, elevators, and other mechanical devices, and also general sanitary and health conditions) in all forms of building and construction. 1/ While the Detroit experience is highlighted, the combined inspections in Phoenix and Los Angeles are also considered.

Crisis in Detroit's Market for Existent Housing--With 350,000 single-family homes, Detroit leads the Nation in that type of residence. The city was therefore particularly affected by a 1968 Federal housing program, administered by the Department of Housing and Urban Development (HUD), which

provided insurance for home purchases by low-income families who had been renting. Numerous homes turned out to be "substandard," and unwary purchasers were in "vulnerable positions and were, indeed, victimized," according to the director of the Building Department. The abuses were multiplied when purchasers could not afford the extensive repairs required and at the same time meet mortgage payments; as result, ownership changed hands rapidly and speculators made considerable gains.

Detroit suggested to HUD that the problem might be alleviated if the maximum feasible number of inspections were made on such houses. (As in many other communities, Detroit had no ordinance requiring inspection of single-family housing at time of sale.) These inspections were carried out initially by four specialized inspectors, each of whom had to visit each site. By 1971, the progressively worsening situation became intolerable. The volume of sales was three times greater than HUD estimates and a large backlog of unfulfilled buyers was developing. The four-in-one inspection seemed to offer the best way to shorten inspection time.

Serious challenges to the new system arose from the start because of either no standards or a diversity of standards for inspecting existent housing: for example, different electrical codes were applicable, depending on when homes were built; further, no simple foolproof test existed for carbon
80 monoxide combustion in furnaces. (Furnaces

in place for at least 15 years were found most likely to present a hazard and a quick and easy test, now referred to as the Detroit Sodium Ion Test, was developed.)

Within a few months of its adoption, four-in-one inspections had assured a "minimum level of habitability" for an existing home purchased anywhere in the City of Detroit. HUD wanted to sell the homes which it had acquired on default but at the same time it became more selective about homes it would insure. HUD entered into a "cooperative arrangement" with the Building Department, as did the Veterans Administration (VA). This provided for inspection and approval by the city of existing homes for which purchasers desired HUD or VA insurance. (The city's satisfaction with four-in-one inspections is reflected in the ordinance it enacted requiring inspection at sale of all existing homes and not merely those insured by HUD or VA.)

Training for Four-in-One Inspectors--Most of the trainees were young persons who had been city health inspectors; however several were 40 to 50 years old and had over 10 years experience in sanitary and surface maintenance inspection of existing dwellings. Had the opportunity to retrain not existed, all these inspectors would have been permanently laid off.

At the outset of the program, the duration, method, and content of the training were conditioned by a crisis which loomed over the time needed to complete inspections. The

Building Department increasingly fell behind and finally required about eight weeks from the date of application to the completed inspection. While this was about the same period needed to process a home mortgage, the Building Department nonetheless considered this delay unacceptable. Since an even greater demand was expected in the four months from June-September 1971, the training course was also set for that period. A course of inhouse and field instruction had to be developed quickly by the chief and assistant chief inspectors of the electrical, heating, plumbing, and structural divisions.

As in the Westvaco case, the electrical portion of the training presented the most severe challenge. However, the objective of bringing every trainee up to "minimum credentials" in every one of the specialties was achieved, due, in no small measure, to the effectiveness of several inspectors as instructors. Continuing classroom instruction has been conducted over the past four years for part of each Friday morning. The director of the Building Department feels it would have been preferable to develop a carefully planned training program such as Los Angeles did.

Occupational Upgrading, Production, and Productivity--Despite the less-than-ideal training, occupational upgrading did take place. The 35 former health inspectors developed new skills and upgraded their earnings. The inspectors finally caught up on the backlog, and about 60,000 homes were in-
82 spected in a 3-1/2 year period. However,

the output of the inspectors is not always in the form of an "inspection," but rather as an "observation." Specialist inspectors are still used for "unusual cases" as well as for industrial, high-rise, and commercial building inspections.

Productivity has risen nearly threefold; travel time has decreased; scheduling has been simplified; and several inhouse evaluations show that the four-in-one inspectors have "the highest productivity and the highest morale" of any other group and are the "most urban-crisis centered. They're aware of being on the firing line, and they like being there."

The shift to four-in-one building inspections raised concerns about job security, since both occupational jurisdictions and wage differentials were at stake. Yet, according to the Building Department director, in a crisis it is possible to "develop something new and innovative that otherwise might not be feasible."

The "Buddy System" in Phoenix--The program used to train 15 specialized housing inspectors in Phoenix as combination or four-in-one inspectors was similar to that in Detroit but with major differences: the trainees were older (average age of over 40) and Phoenix was not activated by a crisis. There had been some "pressure" for combined inspections, but the volume of new housing had not been excessive, and applying it to existing housing had not been seriously considered. However, new construction

picked up and by late 1970 retraining began. Additional inspectors were retrained as needed to keep up with new housing construction.

A six-week program consisted of four hours of inhouse instruction per week provided by experienced, specialized inspectors in electrical, plumbing, structural, and mechanical "technologies" (the term used by the assistant director for building safety). The "buddy system" involved teaming trainees from different crafts. After completion of the formal six-week training period, the new combined inspectors inspected homes which had been inspected previously. Only gradually were these inspectors given the opportunity to visit new tracts or custom built homes where errors in workmanship could exist. Finally they examined remodeled homes, which are the most demanding, particularly when the work is done by the homeowners.

To insure that building code requirements are "expertly and fully met," it was considered necessary to limit the volume and variety of work undertaken by the combination inspectors. They are responsible for single family homes, including townhouses and duplexes. They cannot inspect high-rise buildings: the elevators alone still require a specialized inspector. Each inspector has one hour allocated each week for retraining to keep abreast of changes in building codes and technology.

The administrators are generally pleased
84 with the combination inspection program, and

they feel that the inspectors now find their jobs more satisfying. However, "a bit of resentment" may still be evident when inspectors are asked to share the special expertise they had before their retraining.

Evolution of the Training Program in Los Angeles--Because it went through several stages of evolution, the program for training combined inspectors in Los Angeles is more traditionally characteristic of a technology. Los Angeles was the first major municipality to initiate four-in-one inspections and influenced Detroit, Phoenix (which benefitted from training materials), and other large communities.

Early in 1965, Los Angeles undertook a pilot program to test the feasibility of retraining for combined inspection, and after one year retraining was held to be workable. By December 1966, the anger and frustration of homeowners and builders over multiple inspections provided the Mayor and City Council with the major impetus to insist that a four-in-one inspection system be developed for one- and two-family dwellings, accessory buildings, and swimming pools. The program began on a "crash basis"; however, a sharp cutback in private construction was underway at the time (which the inspectors found fortunate).

The experience gained in the pilot program also helped by making it possible to enroll the first class of inspectors in a full-time, 5-1/2 month training program. Supervisors using materials developed by the

senior inspectors conducted morning classes and what was learned was applied in afternoon field inspection training which utilized the buddy system. Trainees' "apprehension" regarding their capability to "effectively inspect and gain recognition from the craftsmen, contractors, and homeowners" was "dispelled" by assigning "increasingly complex tasks" which, once mastered, instilled confidence.

When the second class for September 1967 was being formed, interest was so great that nearly all the inspectors took a required competitive examination to qualify. The course included "refinements, because we too learned as we went along," according to the general manager of building and safety.

The third class, which began in May 1968, was expanded to include inspection of existing housing under the HUD program mentioned in Detroit. Combined inspectors were found to be especially productive in the inspection of rehabilitated housing. The Building and Safety Department estimated that newly trained inspectors were nearly six times more efficient than the specialized inspectors. By the summer of 1969, more than 200 inspectors had been trained. A sixth class was started in September 1969 to replace people who had retired, were promoted, and resigned.

The Department of Building and Safety modified the program over time and enlisted the help of the Los Angeles Trade and Technical College, a public institution, to devise
86 a 64-unit, two-year curriculum leading to a

degree or certificate covering all phases of construction inspection. In September 1970, all classroom instruction shifted to the college: day classes were held for new students and night classes offered retraining for employed inspectors. The program now requires two years of college or its equivalent in order to enter a three-year training program consisting of OJT plus a minimum of 12 "inspection technology" courses.

Chapter 6. Footnotes

1. National Commission on Productivity and Work Quality, Employee Incentives to Improve State and Local Government Productivity, Washington: USGPO, March 1975, pp. 37-38.

CHAPTER 7. THE CASE FOR CONTINUING EDUCATION/TRAINING

Referring to the problem of helping workers adapt to change, John T. Dunlop wrote: "Training to increase versatility while employees have jobs is preferable to waiting until they are out of work." 1/

However, retraining is usually episodic or occurs in response to technological changes. The ad hoc nature of retraining is accentuated by the fact that training unrelated to any technological change is not pursued on a continuing basis by the great bulk of the work force. And while employers initiate much of worker retraining the main impetus, as a study of the Cleveland labor market showed 2/, comes from a shortage of skilled manpower. A tight labor market is hardly the ideal setting for training, especially on-the-job training which directly competes for the time already strained to maximize production. Competition between time allocations for production and training could be minimized by providing training on a more continuous basis, including periods of worker unemployment.

Tuition Aid as a Form of Continuing Education--Tuition aid, a form of continuing education which is not necessarily continuous, is defined by BLS as payment by employers for job-related training courses taken by employees. Only a limited number of workers have enrolled for tuition aid, but the idea may yet gain widespread support. Contrasting tuition aid with OJT in collective

bargaining agreements covering 1,000 or more employees, OJT bulked much larger than tuition aid programs for the years 1966-67 and 1974; tuition aid is for courses taken off the job site; in addition to applying to "training," as does OJT, tuition aid also can be used for "education" courses, albeit still job-related.

The number of tuition aid clauses in collective bargaining agreements is small, but it did double between 1966-67 and 1974, from 30 to 60; the number of workers entitled to tuition aid increased by 24 percent, from nearly 700,000 to only about 900,000. 3/ Although coverage doubled in nonmanufacturing, which was considerably faster than the increase in manufacturing industries, tuition aid is still most heavily represented in manufacturing. This is noteworthy because employment in several of the nonmanufacturing industries is growing at faster rates than in manufacturing. In both periods, three quarters of the tuition coverage was respectively in transportation equipment (within the category of manufacturing), and the communications industries (within the category of nonmanufacturing). In considering the actual use of tuition aid by entitled workers a sizable corporation found that its tuition refund plan, which had been in force for several years, was used rather extensively only by salaried employees. An "insignificant" percentage of hourly employees used tuition aid (exceptions were upwardly mobile workers, including those aspiring to move into managerial ranks). This firm's observations are consistent with a 1967 study of

tuition aid programs in 155 companies and probably typifies the situation in most corporations with 1,000 or more workers. In the 1967 study, the median rate of participation in the programs by eligible employees was less than 5 percent; a majority of the participants were salaried male employees, and about 70 percent of the participants were engineers, scientists or technicians, and supervisors. 4/ State and local government programs offer such educational incentives as tuition reimbursement, time off to attend courses, wage increases based on educational accomplishment, or a combination of these. 5/

An Exemplary Experience with a Tuition Aid Plan--The Kimberly-Clark Corporation has an education assistance plan, called the Educational Opportunities Plan, or the EOP, with an overwhelming choice of job-related courses and unusually liberal provisions. (Unless otherwise noted, the description of the EOP is based on telephone conversations with and materials supplied by the plan's administrator.) The EOP covers all employees, including hourly and exempt and nonexempt salaried employees (as distinguished by overtime pay coverage of the Federal Fair Labor Standards Act). All nonunion employees became eligible at once. While only two small locals have voted to be included thus far, several large unions renegotiate their contracts this year. Eligible employees can enroll in any education or training course--whether job-related, academic, or even "cultural"--as long as it does not essentially entail sports, recreation, physical development, hobbies, or travel. 91

Employees are assigned a sum of money for "self-development" throughout a fiscal year starting July 1; the money cannot be carried over beyond the year, but another sum is alloted at the start of each year. The amount for nonexempt salary and hourly employees is based on the Corporation's earnings. The employee allotment (KimEd) for exempt salaried employees is based upon corporate earnings plus three other factors--performance rating, base annual salary, and whether or not a "self-development plan" is submitted.

Also at the start of each year, an amount equal to 25 percent of an employee's KimEd allotment is credited to a Family Education Savings Account; if an employee elects to deposit up to $200 yearly in this account, the Corporation will add 20 percent of those savings. The family account, which earns income, "may be used for specified post-high school educational expenses of the employee or members of his or her immediate family"; spouses are not restricted by a post-high school requirement.

The participation rate in the company's old tuition reimbursement plan was between 1 to 5 percent; participation for the first year of the "entirely voluntary" KimEd was startling.

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Types of Employees	Number Eligible	Percent Participation in KimED		Percent Participation in Family Education Savings Account	
		1974	1975	1974	1975
Exempt Salaried	2,960	43.4	44.5	65.9	65.6
Nonexempt Salaried	1,818	36.3	39.9	41.0	38.6
Hourly	2,470	8.5	9.3	23.7	22.3
Weighted Average		29.6	31.2	45.1	43.9

The corporation supports the EOP and its president believes "that an organization's strength, creativity, and possibilities for sustained and future growth are heavily dependent upon its capacity to develop the talents and potentialities of its people." 6/ Such top-level support is undoubtedly important--various State and local government incentive plans (including educational incentive plans) have probably failed because one or more levels of management did not support the plans sufficiently. 7/ However, the relatively high participation rate by employees is attributed primarily to the voluntary nature of the plan; that lack of any company pressure has made a genuine expression of "self-motivation" possible and "people are proud to be trusted to do their own planning."

Despite the considerable latitude in the nature of courses which could be selected, job-related activities were chosen by: over 96 percent of participating exempt salaried employees; over 82 percent of nonexempt salaried employees; and two-thirds of hourly paid employees. The high rate of job-related courses probably reflected a desire to upgrade jobs, progress in careers, and increase options in case of technological change. (Technology has changed gradually in this division of the paper industry; thus education and training as help to adjust is only speculative.)

Adult Education--Adult education, an ongoing, large program, is a form of continuing education. Indeed enrollment (and not simply

coverage) in adult education is considerably larger than the formal OJT plus tuition aid plans in collective bargaining agreements for 1,000 or more workers. For the year ending May 1972, the number of participants in adult education was about 17.5 million. Of these, almost 50 percent gave job-related reasons for participation in adult education. (Improvement or advancement in their jobs was cited by nearly 40 percent; securing a new job was given by another 10 percent.) 8/

Moreover, according to Willard Wirtz, many of those preparing for new jobs were trying to adapt to technological change which had made their former skills "obsolete." 9/

Paid Educational Leave--This is leave of absence for the purpose of acquiring job-related education. On July 1, 1974, nearly 715,000 workers were eligible for this benefit in collective bargaining agreements for 1,000 or more workers, or over four-fifths the number covered by tuition aid plans. Manufacturing industries accounted for 97 percent of all potential enrollees in leaves of absence. Three-fourths of all covered workers were from only two of these industries--primary metals and transportation equipment. 10/ Unfortunately, little is known about educational leave--participation rates, kinds of persons benefiting, length of the leaves, and the costs, which may be "...obscured even within the specific enterprise or public agency granting such leaves." 11/ In general, educational leaves seem to be granted to managerial or highly skilled employees. While educational leaves in the private sector are provided in

collective bargaining agreements, educational leaves are available to Federal employees via legislation, presidential executive orders, and civil service regulations. Some State administrative agencies also provide educational leaves. 12/

Educational leaves are for either vocational and career education; college education to enhance career mobility; and to train/educate in "union business." 13/ The number of agreements and the number of workers potentially eligible for union business leaves is far in excess of those covered for possible educational leaves. Indeed the number of workers--more than 4.6 million--is 1.2 million greater than those eligible for OJT. Just as "work related" OJT seems to be of most interest to employers, unions seem to emphasize leaves of absence for "union business"--consisting partly of summer residential programs for union leaders.

Several governments and employers in Europe have, in recent years, been providing educational leaves and stipends for up to one year. 14/

In June 1974 the International Labour Organization adopted a recommendation for paid educational leave which was approved by management, labor, and government representatives in the U.S. delegation. The recommendation states in part:

...[T]he need for continuing education and training related to scientific and technological development and the changing pattern

of economic and social relations calls for adequate arrangements for leave for education and training to meet new aspirations, needs and objectives of a social, economic, technological and cultural character....15/

Federal Government Role in Adapting to Technological Change--To the extent that the government has become directly involved in the impact on manpower of new technologies, its responses have been ad hoc and shifting in terms of the populations served. Concern for unemployment due to technological or other changes in private industry led during the 1950s to the enactment of the Area Redevelopment Act and then, in 1962, the Manpower Development and Training Act. Under these acts, in addition to retraining, selected displaced workers often received job counseling and, in some cases, financial incentives to move to a more promising geographical area.

However, as early as 1965, the legislation was amended and emphasis turned away from technologically unemployed persons to persons and groups identified as being poor and disadvantaged. Garth Mangum and others have suggested that the disadvantaged were often hopeful of becoming qualified and accepted for some of the well-paying jobs in high-technology industries. 16/ In addition, it was not clear "/w/hether job displacement itself was infrequent, or whether skilled workers were easily rehired in new jobs...; the main result, however, was that public demand was minimal for Federal programs

of retraining of other than the disadvantaged." 17/ It is not yet apparent to what extent the recently enacted Comprehensive Employment and Training Act (CETA), which includes the programs available under the Manpower Development and Training Act and the Economic Opportunity Act, will specifically affect technological change. (A Special Report of the National Commission for Manpower Policy considers much of the Federal effort and the need for still more coordination among the various manpower programs within different Federal agencies. 18/)

The Zenith Radio Corporation has become involved in a novel and promising pilot program utilizing CETA funds. Over 130 laid-off employees are being trained in a comprehensive course in basic electronics and repair at a private vocational school in Chicago to improve their chances for upgraded positions after they have been recalled. 19/

There are some indications that government-sponsored training and retraining may expand during periods of recession, when most private firms retrench their efforts. Several European countries have already increased skill training to guarantee a larger pool of skilled workers when prosperity returns. At least one American firm has a similar program, especially to spare the layoff of recently hired minority workers. 20/ According to one report, the sizable expenditure for unemployment insurance benefits during a period of high and
98 long-term unemployment "...has made the

expansion of training and retraining an attractive policy substitute for simple income maintenance." 21/

Chapter 7. Footnotes

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17. Valerie I. Nelson, George J. Nolfi (Principal Investigator), and James W. Bush, Jr., Adult Career Education as an Intervention Strategy in Mid-Career Crisis, Cambridge, Mass.: University Consultants, Inc., July 31, 1975, pp. 6-7.

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19. Zenith News, Vol. VIII, No. 2., Feb.-Mar. 1975.

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21. National Commission for Manpower Policy, Recent European Manpower Policy Initiatives, by Charles Stewart, Report No. 3, Washington, D.C., Nov. 1975, p. 27.

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This volume deals with the experiences of The Automation Fund Committee in trying to adapt workers to the "problems of displacement caused by improved technology." The Committee was set up through collective bargaining between Armour and Company and the Amalgamated Meat Cutters and Butcher Workmen and United Packinghouse, Food and Allied Workers.

Gerald G. Somers and Myron Roomkin, "Developing Reliable Data on Training in Industry," Monthly Labor Review, Vol. 97, No. 2, Feb. 1974.

This University of Wisconsin study for the U.S. Department of Labor concludes that a survey of training is achievable if it is "properly designed." The survey should consist of personal interviews with small samples of companies and employees and larger mail questionnaire surveys of companies and employees. To begin with, it was suggested that a single industry be surveyed.

(The Bureau of Labor Statistics has completed a mail survey of training activities within the bulk of the metalworking industry. Even such a limited survey proved to be very "costly." The quality of the survey results has not yet been determined, but ultimately a report on the survey findings will be published. However, any future studies will probably have to be undertaken State by State.) 105

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This monograph evaluates the case studies which are reported in the Barkin Volume. See especially Section 7: "The Qualitative Aspects of Manpower Adjustment--Changes in Job Content; Training and Retraining." Training and retraining were found to have played a significant role in 19 case studies and a less important part in numerous other cases.

Willard Wirtz and Harold Goldstein, "Measurement and Analysis of Work Training," Monthly Labor Review, Vol. 98, No. 9, September 1975.

These manpower experts detail the various forms of work training. They indicate that

aside from those being trained by Labor Department-sponsored OJT or apprenticeship, nothing approaching a firm estimate can be made of the number of persons being trained even in formal on-the-job training.

U. S. GOVERNMENT PRINTING OFFICE : 1977 O - 229-735

The 94th Congress created the National Center for Productivity and Quality of Working Life on November 28, 1975, as an independent Federal agency. The Center's enabling legislation (P.L.94-136) establishes a national policy encouraging "productivity growth consistent with needs of the economy, the natural environment, and the needs, rights, and best interests of management, the work force, and consumers." The Center's purpose is to stimulate national efforts to implement this policy.

The Center's small staff of productivity specialists supports the Board of Directors in pursuit of seven main objectives:

- Document and recommend policies to satisfy the Nation's capital investment needs from a productivity standpoint.
- Encourage labor-management cooperation to enhance productivity and the quality of working life.
- Without compromising legislative intent, identify and recommend changes in government regulation which will improve productivity.
- Stimulate and support industry task forces formed to conduct programs for industrywide productivity improvement.
- Develop and recommend more effective approaches to improving productivity in the public sector.
- Improve the review, coordination, and integration of productivity enhancement efforts of other Federal agencies.
- Develop a better understanding of the concept of productivity and encourage better techniques for measuring productivity changes.

The Board of Directors may contain up to 27 members representing business, labor, the Federal Government, State and local governments, institutions of higher education, and others from the private and public sectors. The directors determine the Center's role and activities through committees formed to deal with substantive issues defined in an October 1975 policy statement.

The Center is located in Washington, D.C. It seeks to identify the various points of view affecting productivity growth; determine which of these views can be reconciled to further productivity improvement; and encourage within and among various groups cooperative efforts toward productivity growth.